

ABSTRACT

A combined dot density and size modulation system uses dispersed dot halftoning in conjunction with dot size modulation to produce a halftone image in which both the density and size of the dots are modulated to control overall gray level.

5 The dot density and size modulation system offers advantages over pure dot density modulation systems or pure dot size modulation systems because it allows an extra degree of flexibility which can be used to increase the visual quality of the halftoned pattern and/or increase the robustness of the halftoning to printer artifacts and variations. An input pixel value is used to independently produce a dot density value
10 and a dot size value. The dot density value and dot size values may be obtained from, e.g., look up tables that have been optimized for print quality and printer stability. Dispersed dot halftoning is used to provide a halftone value for the desired pixel location using the dot density value. The dispersed dot halftoning may be, e.g., tone dependent error diffusion. The halftone value and the dot size value for the pixel
15 location is then used to generate a modulated code, e.g., a pulse width modulated code, to the printer. The modulated code may include both the pulse width of the desired dot for the pixel location as well as the justification, e.g. left, center, or right, for the pixel location. The dot density and size modulation system is particularly useful in modern electrophotographic printing systems that allow the printed dot size
20 to be almost continuously varied through the specification of a pulse width modulation (PWM) code.